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**United States Patent** [19]

Paul et al.

[11] **Patent Number:** **6,019,882**[45] **Date of Patent:** **Feb. 1, 2000**[54] **ELECTROKINETIC HIGH PRESSURE  
HYDRAULIC SYSTEM**[75] Inventors: **Phillip H. Paul**, Livermore; **David J. Rakestraw**, Fremont, both of Calif.[73] Assignee: **Sandia Corporation**, Albuquerque, N. Mex.[21] Appl. No.: **09/057,017**[22] Filed: **Apr. 7, 1998****Related U.S. Application Data**

[63] Continuation-in-part of application No. 08/882,725, Jun. 25, 1997.

[51] **Int. Cl.<sup>7</sup>** ..... **C12Q 1/68**; B01J 19/00;  
G01N 33/48[52] **U.S. Cl.** ..... **204/450**; 204/600; 204/647;  
204/648[58] **Field of Search** ..... 204/450, 600,  
204/647, 648[56] **References Cited****U.S. PATENT DOCUMENTS**

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**OTHER PUBLICATIONS**Pretorius et al., "A New Concept for High-Speed Liquid Chromatography." *Journal of Chromatography* pp. 23-30, 1974.*Primary Examiner*—Arun S. Phasge*Attorney, Agent, or Firm*—Donald A. Nissen[57] **ABSTRACT**

A compact high pressure hydraulic pump having no moving mechanical parts for converting electric potential to hydraulic force. The electrokinetic pump, which can generate hydraulic pressures greater than 2500 psi, can be employed to compress a fluid, either liquid or gas, and manipulate fluid flow. The pump is particularly useful for capillary-base systems. By combining the electrokinetic pump with a housing having chambers separated by a flexible member, fluid flow, including high pressure fluids, is controlled by the application of an electric potential, that can vary with time.

**3 Claims, 3 Drawing Sheets**